

CONFERENCES

IMPERIAL AGRICULTURAL RESEARCH
CONFERENCE, 1927.

REFERENCE
ONLY

Agenda : Memorandum 2.

Chain of Research Stations.



Issued by the Organising
Committee of the Conference,
10, Whitehall Place, London, S.W.1.

September, 1927.

LONDON:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE,
By WYMAN & SONS, LTD., FETTER LANE, E.C.4.

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IMPERIAL AGRICULTURAL RESEARCH CONFERENCE, 1927.

AGENDA : MEMORANDUM 2.

Proposed Chain of Tropical and Sub-Tropical Research Stations.

1. The Research Special Sub-Committee of the Imperial Conference, in referring to the possibility of establishing new Research Stations in suitable centres in the tropical and sub-tropical parts of the Empire, pointed out that "the ultimate idea is the creation of a chain of research stations linked together by a common interest in related problems, and providing a fertile field for team work and the interchange of ideas and men throughout the Empire." (Report of Research Special Sub-Committee, page 14, para. 66,—Appendix, Paper 2.)

2. The Imperial Conference passed a resolution expressing its cordial approval of "the project of fostering a chain of research stations situated in appropriate centres in tropical and sub-tropical parts of the Empire, and commending this project to the sympathetic consideration of Governments, Institutions and private benefactors throughout the Empire." (Cmd. 2768, p. 50—Appendix, Paper 3.)

3. The Colonial Office Conference accepted "the necessity for a chain of group research stations throughout the Empire," and pointed out that for this purpose the Colonies fell into the following groups : West Africa, East Africa, West Indies, the Far East, and possibly the Middle East. (Cmd. 2883, p. 34—Appendix, Paper 4.)

4. The Governments of the Empire have thus unanimously agreed that measures should be taken to establish an Empire chain of research stations on tropical and sub-tropical agriculture. There can however be no question of hastily summoning into being a number of new stations of this kind. The lack of trained men qualified to run them would alone prohibit any such immediate step. On the other hand the Imperial Agricultural Research Conference offers an exceptionally good opportunity for a discussion of the subject, and for the framing of a provisional programme, as a guide to those who may have opportunities in the coming years of forwarding its execution. The purpose of this paper is to indicate the present organisation of tropical and sub-tropical research and to inform the Conference of certain proposals which have been discussed or are in contemplation. The information which it gives and the suggestions which it records can no doubt be supplemented by those attending the Conference.

Existing Organisations.

5. Although tropical and sub-tropical agriculture present specific problems of their own, there is no complete severance between the needs of tropical, sub-tropical and temperate agriculture. The relation, therefore, between the proposed chain of stations and the research stations already existent in the United Kingdom and other temperate parts of the Empire must not be lost sight of. In the following paragraphs an account is given of some of the existing institutions in tropical and sub-tropical parts of the Empire which should be considered in the framing of any long-range programmes.

6. *The Imperial College of Tropical Agriculture, Trinidad.** This College is the only adequately equipped training centre and the principal research institute in the Colonial Empire. It was opened in October, 1922, and was granted a Royal Charter in November, 1926. The total capital expenditure upon the College has been in the neighbourhood of £150,000, and the maintenance charges amount to about £25,000 per annum, contributions towards which have in the past been made by the Imperial Government, and by the West Indian Colonies by a $\frac{1}{2}$ per cent. levy on their revenues. Lately the Empire Marketing Board and the Empire Cotton Growing Corporation have each made a grant of £21,000 towards further capital expenses of the College and the Empire Marketing Board has made a grant in aid of revenue of £8,000 in respect of the financial year ending August 31st, 1927.

7. The professorial staff of the College consists of 1 Principal, 8 Professors and 9 Lecturers. The College provides a three-years' course for its Diploma in Tropical Agriculture, and a one-year's course which is largely followed by students passing on to the Agricultural Departments in various Colonies. There are now 42 students in residence at the College.

8. The College publishes a monthly journal entitled "Tropical Agriculture," and in addition to teaching work undertakes research on such subjects as the breeding of varieties of banana immune to Panama disease, the froghopper pest of sugar-cane, wither-tip disease in limes, and the study of colloidal soils.

9. *The Amani Institute.*—The only other overseas research station of a definitely Imperial or inter-Colonial character is the Institute at Amani, where work is about to be restarted. As the functions of this Institute will be exclusively research, it is probably nearer to the type of the new stations contemplated than is the Imperial College.

10. The six Governments of Tanganyika, Kenya, Uganda, Zanzibar, Northern Rhodesia and Nyasaland are providing between them an annual contribution amounting to £8,000, and the Empire

* A detailed account of the College is given in Appendix, Paper 8.

Marketing Board is making a grant up to one-third of the total running costs, not exceeding £6,000 in any one year. The capital expenditure required will be charged to the East African Guaranteed Loan.

11. The new Director of the Amani Institute is Dr. Nowell. The object of this research station will be to undertake problems of long range research, and to supplement more particularly the research activities of the East African Dependencies. (*See also Appendix, Paper 10.*)

12. *South Africa*.—The remarkable work of the Veterinary Research Institute at Onderstepoort must be recorded in any account of the outstanding overseas institutions already engaged in research affecting the tropical and sub-tropical parts of the Empire. The work of this Institute is too well-known to require a special description in this paper.

13. *India*.—The research organisations of India do not normally undertake fundamental work on the same basis as some of the institutions in the United Kingdom, but they must not be overlooked in such a survey as the present. India has the Imperial Agricultural Research Institute and College at Pusa, the Imperial Institute of Agricultural Husbandry and Dairying at Bangalore and another institute of the same name at Wellington in Madras, an Imperial Cattle Breeding Farm in the Punjab, an Imperial Dairy Factory at Anand in Bombay, the Institute of Plant Industry at Indore, and the special research stations for sugar cane at Coimbatore and for cotton at the Bombay Technological Laboratory. These are all central Institutions under the Government of India.

New Stations Proposed.

14. The following new stations have already been discussed or proposed :—

(i) *Australia*.—The Commonwealth Government, in consultation with the Empire Marketing Board, are planning a Research Station in Northern Queensland. The capital cost (estimated at £50,000) and the maintenance expenditure (estimated at £10,000 per annum) would be shared equally by the Empire Marketing Board and the Australian Government. It has been suggested that this station should act as a centre for research in animal husbandry and nutrition in the tropics and possibly also for pasture problems (Appendix, Paper 7.)

(ii) *Ceylon*.—It is understood that the establishment of a station at Peradeniya is being considered by the authorities who are considering the Report of the Colonial Office Conference.

- (iii) *East Africa*.—It has been suggested that a central station for veterinary research should be established at Kabete, Kenya Colony. (Appendix, Paper 6.)
- (iv) *West Africa*.—The Colonial Office Conference noted that the West African Colonies had reached the stage of holding group conferences for the allocation of research work between them. It is understood that the ultimate establishment of a West African Station is probable. (Appendix, Paper 11.)
- (v) *Federated Malay States*.—Suggestions have been made for a central station in the Federated Malay States to undertake tea and rubber research.
- (vi) *Stations for Sugar and Copra Research* have also been suggested. It is for consideration whether new stations would be required for this purpose, or whether each subject could be dealt with by one of the stations which exist or are in immediate contemplation. (See Appendix, Paper 9.)
- (vii) *A Station for Irrigation* has been suggested and it has been thought that such a station might most advantageously be established in the Middle East.

15. This memorandum does not deal with the question of relations between research stations, *e.g.*, interchange of workers, etc., which are dealt with in other Conference papers. (Agenda Memoranda 1, 3, 4 and 5.)

APPENDIX.

1. Lovat Committee Report : Chain of Central Research Stations.
2. Research Special Sub-Committee of Imperial Conference, 1926. Report, paragraph 66.
3. Imperial Conference, 1926. Summary of Proceedings, p. 50.
4. Colonial Office Conference, 1927. Summary of Proceedings : Chain of Research Stations.
5. Colonial Office Conference, 1927. Appendices to the Summary of Proceedings. Appendix V: Agricultural and Veterinary Research in the Colonies, Protectorates and Mandated Territories. Memorandum by the Parliamentary Under-Secretary of State for the Colonies.
6. Colonial Office Conference, 1927. The Control of Animal Disease in the British Empire. Memorandum by Sir Arnold Theiler.
7. Australia, Memorandum : The proposed Queensland Tropical Agricultural Research Institute.
8. The Imperial College of Tropical Agriculture, Trinidad, B.W.I. By G. Evans, M.A., C.I.E.

9. Mauritius, Memorandum : Advantages for the extension of Sugar Research on an Imperial Basis in Mauritius.
10. Tanganyika. Memorandum : Development of Agricultural Research Institutions in Central Africa.
11. Nigeria, Memorandum : Agricultural Colleges and Central Research Institute.

1. LOVAT COMMITTEE REPORT.

Chain of Central Research Stations.

91. The constitution of further central research stations must be worked out in the light of the experience gained at the Imperial College in Trinidad, and at the Amani Institute. We wish, however, to make the following observations :—

92. The main function of each station will be to place at the disposal of the Colonies in its group, for the purpose of attacking the more difficult problems confronting them, staff and equipment which they cannot individually afford to maintain. In this connection it should be remembered that to tackle fundamental problems of research with any but first-class research workers is likely to result in a waste of time and money ; that first-class research workers are comparatively rare ; and, consequently, that it is necessary to concentrate them at chosen spots where good equipment can be provided for them, rather than to scatter them over the numerous Colonies which require their services.

There are various ways in which the station can assist its group of Colonies.

Certain problems, particularly those of pure research, may be handed over to it entirely.

In others the best results may be gained by investigations undertaken jointly by the staff of the research station and the specialist officers in the Colony.

The specialist officer should be free to seek the advice and assistance of the station in any investigation where he finds himself in need of it. On occasions he may be sent for a period to work at his problem in the central station.

An important function of the station will also be to loan officers to Colonies, on invitation, for the purpose of dealing with particularly difficult problems.

The station may do a certain amount of minor educational work, and officers from agricultural departments within the group might with great advantage visit the station for short periods to acquaint themselves with the research work which is being carried out there. Except, however, in the case of the Imperial College in

Trinidad, which has already begun to take a vital part in the training of Colonial agricultural officers, the main duty of the stations will be research.

93. The stations should definitely form part of a scheme of Imperial research. They should be able to rely upon sufficient funds to ensure a reasonable prospect of security of tenure to the staff, and to enable the directing authorities to undertake the investigation of problems which may involve a prolonged period. The Imperial College in Trinidad is not a Government institution, but it seems probable that any future central research stations would be under Government control and that their staffs would be Government officers. Such an arrangement has the definite advantages that an interchange of the staffs of the stations and of the Colonial agricultural departments can more easily be effected, and that the relations of the Colonial agricultural departments with a Government-controlled station are likely to be closer than with a private institution. At the same time, we would not wish to rule out the creation of a station under private control, nor the carrying out of research, which has been privately endowed, at a station under Government control.

94. We consider that, as far as possible, the terms of service of officers in the different research stations should be made equally attractive, due allowance being made for the climatic and other conditions of the respective stations.

95. To obviate the difficulties which might conceivably arise between the research station and Directors of Agriculture in the Colonies, we feel that two definite rules must be laid down :—

- (i) An officer from the central station should not undertake work in a Colony except by invitation from that Colony.
- (ii) While performing such work he must be absolutely under the executive control of the Director of Agriculture of the Colony.

If these rules are observed, each Director would remain fully acquainted with, and absolutely responsible for, the agricultural work carried out on behalf of his own Government in his own Colony.

96. We recommend that, as well as being eligible for promotion in the ordinary course within their own departments, specialist officers in agricultural departments should be eligible for promotion to the staffs of research stations, and, from those staffs, to higher positions in the agricultural departments. This will tend to draw off some of the best of such officers from individual Colonies ; but the prospects of advancement and of greater scope which the stations will offer will, we are confident, help to attract and retain men of first-rate ability, and will raise the standard of the recruits to the

specialist side of agricultural departments to the direct advantage of the Colonies.

97. At the same time we must sound a note of warning with regard to the staffs of the research stations. Partly owing to the effect of the war and partly to the unattractive career which research in tropical agriculture has hitherto offered, there is at present a definite shortage of first-class research workers. It would probably prove difficult to staff a complete chain of Colonial research stations at this moment ; or, if the stations could be staffed from the ranks of the Colonial agricultural departments, to fill the gaps which would be made in their ranks.

98. Moreover, it must be borne in mind that such men take some years to train, and that they will not undergo the necessary specialised training unless there is reasonable prospect of a career at the end of it. Consequently we consider it very important that no time be lost in deciding on a definite policy in regard to these stations, and in settling broadly the staffs they will require and the conditions of service which will be offered. As soon as this has been done, full information as to what is intended should be publicly advertised and circulated throughout all training-centres, in order that promising pupils may be encouraged to prepare themselves for the careers which will be opened up in the field of Colonial agricultural research.

2. IMPERIAL CONFERENCE, 1926.

RESEARCH SPECIAL SUB-COMMITTEE REPORT.

Paragraph 66.

66. In the field of tropical agriculture, the grant made to the Imperial College of Tropical Agriculture, Trinidad, will be followed, it is hoped, at an early date by a grant to the Amani Institute in Tanganyika, and proposals are under consideration for the establishment of other research stations in suitable centres in the tropical and sub-tropical parts of the Empire. The ultimate ideal to which both these lines of approach point the way is the creation of a chain of research stations linked together by a common interest in related problems, and providing a fertile field for " team work " and interchange of ideas and men throughout the Empire. The problems of tropical agriculture, while of immediate interest to Australia and to South Africa, as well as to many of the Colonies and Protectorates, are also of general importance to all parts of the Empire in view of the increasing dependence of temperate countries on the products of tropical and sub-tropical regions.

3. IMPERIAL CONFERENCE, 1926.

Extract from SUMMARY OF PROCEEDINGS.

"The Conference, in particular, expresses its cordial approval of the project envisaged by the Board* of fostering a chain of research stations situated in appropriate centres in tropical and sub-tropical parts of the Empire, and commends this project to the sympathetic consideration of Governments, institutions, and private benefactors throughout the Empire."

4. COLONIAL OFFICE CONFERENCE, 1927.

SUMMARY OF PROCEEDINGS.

Paragraphs 40 and 41.

Chain of Research Stations.

40. We need not argue the necessity for a chain of group research stations throughout the Empire, the principle of which has been approved by the Imperial Conference. The Imperial Conference proposed that the development of this chain of group research stations should be assisted by the Empire Marketing Board, with whom the Council would co-operate as far as stations in the Colonies were concerned. These stations will deal not only with special problems of the group in which they are situated, but also with problems of Imperial interest allotted to them.

41. The Colonies for this purpose fall into four or possibly five groups—West Africa, East Africa, West Indies, the Far East, and possibly the Middle East. The Imperial College of Tropical Agriculture in Trinidad has been established and the Institute at Amani is about to be reopened, while the West African Colonies have reached the stage of holding group conferences for the allocation between them of research work. We consider that the next link in the chain should be in the Far Eastern group. The creation of a research station in that group is in our view most important, as it would provide a link between the research work carried out by the existing local independent research stations in this area devoted to the problems of one particular crop, for example, tea and rubber, and the research work carried out in other parts of the Empire.

* Empire Marketing Board.

5. COLONIAL OFFICE CONFERENCE, 1927.

APPENDICES TO THE SUMMARY OF PROCEEDINGS.

APPENDIX V.

**Agricultural and Veterinary Research in the Colonies,
Protectorates and Mandated Territories.**

MEMORANDUM BY THE PARLIAMENTARY UNDER-SECRETARY OF
STATE FOR THE COLONIES.

* * * * *

Our only adequately equipped training centre and our principal research institution in the Colonial Empire is the Imperial College of Tropical Agriculture in Trinidad, which was opened in October, 1922. Its professorial staff consists of a Principal with eight Professors and nine Lecturers.

The total capital expenditure, including payments to which the Governing Body is committed, stands at £147,750. Towards this amount upwards of £87,000 was received as a result of Lord Milner's Special Appeal, and contributions from the Imperial Government, the Empire Marketing Board, and the Lancashire Cotton Industry. The Rhodes Trustees contributed the sum of £5,000 towards this Fund, whilst £15,000 has been granted by the Imperial Government towards the erection and equipment of the Hostel, and the Empire Marketing Board contributed £21,000 for various purposes contingent on a similar grant of £21,000 being given by the Lancashire Cotton Industry, largely through the Empire Cotton Growing Corporation, who, in this, as in all other matters, have been of great help not only to the Colonies but also in scientific investigation of many important problems. But by far the largest individual contributor to the funds of the College has been the planting community of Trinidad and Tobago, which provided through the Government of the Colony, by means of a special export tax imposed by their special request, £50,000 for building purposes.

Apart from capital expenditure the annual cost of maintaining the College is approximately £25,000 a year. Towards defraying this approximately half of the total amount is provided by a contribution of one-half of one per cent. of their revenues made by Trinidad and Tobago, Barbados, the Windward Islands, and the Leeward Islands. The following Colonies also contribute towards the cost of maintenance: British Guiana £1,000, and British Honduras £50 annually; Nigeria £1,200 annually for five years; Gold Coast £500 annually the Anglo-Egyptian Sudan £500 annually for five years; Sierra Leone £250 annually; and Southern Rhodesia £100. Other annual contributions include £1,000, expiring in 1929, from the Rockefeller Foundation for a Chair of Tropical Sanitation

and Hygiene, and £1,000 from the Carnegie Corporation for the Library, while in addition to making capital grants the Empire Cotton Growing Corporation and the British Cotton Growing Association subscribe £500 and £200 a year respectively.

The College provides a three-years' course for its diploma and a one-year course which is largely followed by the students passing on to the Agricultural Departments in various Colonies. As I have already said, the College was opened in 1922 ; in 1923 four students completed the one-year course, six in 1924, thirteen in 1925, and sixteen in 1926. Diplomas at the end of three-year courses were granted to five students in 1925, and three in 1926. There are now forty-two students in residence at the College.

The College has issued a monthly journal since 1st January, 1924, entitled *Tropical Agriculture*, a valuable production the scope of which could, I think, with advantage be extended, if funds and staff permit. In addition to teaching, research work has been commenced on such subjects as the breeding of a variety of bananas immune from Panama disease, the problem of Frog-hopper blight in sugar-cane, Withertip disease in limes, and the study of colloidal soils.

The only other research station of an Imperial or inter-Colonial character, apart from those maintained for purely local purposes, is the Amani Institute in Tanganyika Territory. This Institute, as is well known, was established by the Imperial German Government and had already made considerable contributions to the science of tropical agriculture before the war. The work of this Institute is now about to be re-started and has been rendered possible by the co-operation of the six Governments of Tanganyika, Kenya, Uganda, Zanzibar, Northern Rhodesia, and Nyasaland, in providing between them annual contributions amounting to £8,000.

In addition to this sum the Empire Marketing Board have decided to make a maintenance grant up to one-third of the total running costs of the Institute not exceeding £6,000 in any one year. The capital expenditure necessary for the re-habilitation and re-equipment of the station, which is being advanced by the Government of Tanganyika, will eventually be charged to East African Guaranteed Loan funds.

The new Director of the Institute is Mr. W. M. Nowell, D.I.C., appointed to this post from the Directorship of Science and Agriculture in British Guiana. He is now in East Africa ; part of the necessary staff to work under him is being appointed and on receipt of his report it is proposed to proceed with the selection of the remainder. The object of this research station will be to undertake projects of long range research to supplement more particularly the research activities of the East African dependencies, and the work there should also throw an important light on cognate problems both in West Africa and in other tropical dependencies. It will

form one of a chain of Imperial research stations in the tropical and sub-tropical Empire.

It is obvious that Trinidad and Amani are two of the links in any such chain. The establishment of further links will require discussion. The establishment of a new station in North Queensland is already under discussion with the Government of the Commonwealth of Australia. It would seem clear that three further links will be required, one in West Africa, one in the Middle East, and one in the Far East. I tentatively suggest that Nigeria, Palestine, and Ceylon might be considered as the most suitable *loci*. These research stations need not necessarily be entirely new institutions but could be built up on the basis of existing institutions. One advantage of such a chain is that certain problems of a long range character could be tried out at the same time in different parts of the Empire and the results compared. The Empire Marketing Board is engaged at this moment in making a preliminary survey of the field.

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6. COLONIAL OFFICE CONFERENCE, 1927.

The Control of Animal Disease in the British Empire.

MEMORANDUM BY SIR ARNOLD THEILER.

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5. *Suggested Measures.*

C.—Research.

It is not proposed in any way to curtail or control the activities of local research institutions, which should continue to expand as local requirements dictate, and local opinion approves. But we need very badly something more than can reasonably be expected to develop—unaided—in that way. We need an Imperial organisation (connected with the proposed Imperial Bureau, *see* Agenda Memorandum 3) to fill in gaps and to amplify.

(1) Research of a certain character is possible in England without involving any danger of local spread, owing to the absence of the appropriate transmitting agents, and it is actually most desirable that much work of this kind should be done in areas where susceptible animals are easily and cheaply procured, and natural infection can be excluded with certainty. There is the added advantage of the presence in England of a greater number of specialists in the many branches of science, as in particular cases it might be desirable to ask such specialists to give attention to special points.

This work could obviously be done best at Weybridge and Pirbright, and it could easily be utilised to furnish material for educational purposes.

(2) One institution within the tropics should be largely extended and developed, to cope with work which could not successfully or

safely be done elsewhere. Although within the tropics, and with easy and rapid means of communication with typically hot and unhealthy areas, the institution itself should preferably be situated at a considerable altitude, in order to permit Europeans to do better work for fairly long and uninterrupted periods.

For this purpose, Kabete seems to be almost ideal; this laboratory could also be used for educational purposes.

(3) The Onderstepoort laboratory, near Pretoria, is admirably equipped to play an important part in any general scheme. It has to be remembered, however, that, owing to the semi-tropical character of the country, one could not exclude the possibility of natural infection or accidental transmission with the same degree of certainty as at Weybridge. On the other hand, the success which has attended the work performed in South Africa during the past thirty years has rendered it impossible now to demonstrate many diseases which formerly occurred there, and which are still of very great importance elsewhere.

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7. AUSTRALIA : MEMORANDUM.

The Proposed Queensland Tropical Agricultural Research Institute.

About one-third of the total area of Australia lies within the Tropics. While much of this area is subject to drought, very large portions of it, particularly in Queensland, never experience a dry season, and further, in many parts of the latter areas the soil is particularly fertile. There is no doubt that large tracts of Queensland tropical areas could be used much more extensively and profitably than they are at present.

At the present time the main Australian activities in the field of tropical agriculture are constituted by the production of sugar cane and bananas. The former industry results in products worth approximately £12,000,000 per annum, but there is little chance of the industry expanding to a very appreciable extent. Even at the present time it more than supplies the total sugar requirements of Australia and is unable to export its surplus without incurring a loss. The industry is deemed to be of such importance to Australia, however, that an embargo has been imposed on all other sugar even though the imposition of the embargo means that the ruling Australian price is considerably higher than would otherwise be the case. The banana industry now produces fruit worth approximately £1,000,000 per annum. It could, however, be extended very considerably and with comparative ease. In addition, numerous cultivation tests carried out by the Queensland Department of Agriculture and Stock and by other authorities have given indications that it would be quite feasible to grow many further varieties of tropical plants in Northern Australia.

An amount of research work in connection with the Queensland sugar and banana industries has already been carried out. The former has been considerably helped by the State Bureau of Sugar Experiment Stations, and the latter by various horticultural researches, and such investigations as those of "squinter" and "bunchy top." Prior to the establishment of any agricultural research station in tropical Queensland, however, it would be necessary to give due consideration to these and to other existing activities such as the operations of the Institute of Tropical Medicine, Townsville, in order that a proper degree of co-ordination might be effected.

The animal industry of the tropical portions of Australia is another important matter to which attention might possibly be given by an Institute of the nature under discussion. At the present time cattle are produced in the North in considerable numbers, but they are subject to certain diseases and attack by insects which do not exist in cooler climates. From constant exposure for many generations to these conditions Asiatic cattle have acquired a high degree of tolerance to them. It would thus appear that the most suitable type of cattle for tropical Australia might possibly be evolved by interbreeding Southern and Asiatic strains. The same condition might also apply to many other animals of economic importance. The carrying out of scientific animal breeding experiments in tropical Australia is, therefore, a matter worthy of serious consideration.

The research work on agriculture and animals that has been discussed above is very closely connected with the further settlement of the North, and many arguments can be put forward to support the view that it would be unwise for Australia to embark on any expensive land settlement schemes in the tropics until more scientific and economic data of the nature in question have been obtained. In fact the future settlement of the North which is so widely recognised as being a matter of extreme national importance that the latter hardly needs stressing here, seems to depend on the measure of success that is obtained in the search for those data.

The question of intensifying the Australian research work on tropical industries is affected by certain proposals which were discussed in a preliminary way by the Prime Minister (Mr. Bruce) and the Under-Secretary for the Dominions (Mr. Amery) at the time of the 1926 Imperial Economic Conference.

It was then proposed that a Tropical Agricultural Research Station should be established in Queensland to form one of a chain of similar institutions throughout the Empire.

The proposal in question has been considered by the Council for Scientific and Industrial Research, by its Queensland State Committee, and by a special Agricultural Conference convened by the Council to discuss agricultural research in general and consisting of the leading State Departmental agriculturists of Australia.

All these bodies warmly support the idea. In addition the State Committee has obtained a considerable amount of preliminary information concerning the work already done, the economic and industrial conditions, rainfalls in various districts, etc. As for the Agricultural Conference, it resolved that "the institution of a Tropical Agricultural Research Station in Australia is essential as a forerunner of the successful and economic development and settlement of the tropical parts of Australia and the Mandated Territories." There is, therefore, no doubt that the proposal would be warmly received throughout Australia. The matter really reduces to one of finance.

8. THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, TRINIDAD, B.W.I.

By G. EVANS, M.A., C.I.E.

The idea of founding a College of Tropical Agriculture for the British Empire has been under consideration for many years, but it was not until the end of the war period, when difficult economic conditions had brought home to everybody the vital necessity for developing the Colonial possessions situated within the tropics, that the movement assumed a definite shape. The first decisive step was the appointment of a Tropical Agricultural College Committee by the late Lord Milner, at that time Secretary of State for the Colonies. The recommendation of this Committee led to the foundation of the College and the selection of Trinidad as the site. The reasons why Trinidad was selected as the site are partly because of its proximity to England and also of its climatic and other advantages which are discussed more fully later on in this note.

It must not be forgotten, however, that the Government of Trinidad and Tobago came forward with the offer of a site at St. Augustine, seven miles from Port of Spain, and also gave in conjunction with the planters of the Colony, the sum of fifty thousand pounds as a contribution towards capital expenditure.

The institution was at first called The West Indian Agricultural College, but in view of the wide scope of its activities, this was speedily changed to The Imperial College of Tropical Agriculture, and as such it commenced its career in temporary buildings, when it was formally opened on October 16th, 1922, by Sir Samuel H. Wilson, at that time Governor of Trinidad and Tobago. Since then development has been singularly rapid: much money has been collected and spent in the erection of the necessary laboratories, equipment and houses and the College is now firmly established as a factor of great potential influence in the development of His Majesty's Tropical Colonies.

The Functions of The Imperial College of Tropical Agriculture,

The aims of the College are firstly to give instruction and training in Tropical Agriculture, and secondly to afford facilities for research in problems connected with agriculture in the Tropics.

For both these purposes it is admirably suited. The staff is highly qualified and the College has been fortunate in securing the services of professors whose names are well known in connexion with the particular sciences in which they have specialised. So far as buildings and equipment are concerned, the Institution is already well provided and when the present building programme has been completed, will be exceptionally well off in this respect. The magnificent central building which was completed two years ago in addition to housing the Botanical, Mycological and Entomological Departments, also contains the Central Office, Lecture Rooms and the Library. The latter is rapidly increasing in size and importance, and will, in all probability, shortly require the whole of the upper storey of the building for its accommodation.

The office of the College journal *Tropical Agriculture* is also accommodated in this building. This publication is rapidly expanding in circulation and more space will be needed in this connexion. The old buildings at present house the Chemical laboratories, the Sugar Technology Department and the Department of Tropical Hygiene and Sanitation.

A portion of the Agricultural Section is also located here. Plans are now being prepared for the erection of a separate block to house the Chemical and Sugar Technology Sections and when this building is completed it will be possible to relieve the congestion in the main building.

A feature of the College is the Experimental Sugar Factory which is capable of producing about 3 tons of sugar a day of 12 hours under favourable circumstances. This Factory has been completely equipped with all the latest machinery and the College owes much to the generosity of the British Sugar Machinery Manufacturers who presented practically all the equipment. The Factory is specially designed for instructional work and is well equipped for research and is capable of turning out all classes of sugar and sugar products.

The cultivable area attached to the College is small, amounting only to about thirty acres, but arrangements are now in hand for the acquisition of a suitable estate in the neighbourhood.

A hostel for the accommodation of about forty students and a combined Dining Hall and Recreation Rooms are now nearing completion and should afford much needed facilities for the overseas students in particular.

The College has its own Works Department, which is responsible for the upkeep of Staff Houses, College Buildings and roads, &c., and also runs the College Electric Power plant and Gas Works.

College Courses.

The object is to provide training in the science and practice of tropical agriculture to students intending to become tropical planters, agricultural administrators, or officers or specialists in one of the various sciences connected with Tropical Agriculture.

At present three classes of students are provided for:—

- (1) The Diploma Course.
- (2) The Post-Graduate Course.
- (3) Special Courses.

The Diploma Course is intended for youths who have just left school, and they must have attained the age of 17 before they are admitted. The qualification for admission is the Matriculation of any British University. As is perhaps naturally to be expected, the majority of the students attending this class are from the West Indies. The Diploma Course lasts for three years, and during this period students receive a good general grounding in the principles of agricultural science with special bearing on the Tropics.

Post Graduates.—This course is an advanced one, and is designed for men who have already obtained a degree or diploma of any British University, College, or Academic Institution approved of by the Governing Body. The course usually lasts one year, and provision is made for instruction in a wide range of subjects so as to meet the needs of the various kinds of students. Particular attention is, however, paid to training in methods of experimentation and research. At the present time, this course is the most widely attended, and it certainly appears to attract a desirable type of student. In addition to attending certain courses of lectures, which are decided on in consultation with his tutor, each post-graduate is required to work on a field prob'em and to write up his results in the form of a dissertation at the end of the academic year.

The Special Courses are not fixed, but are arranged to suit the needs of a particular student so far as possible. They are meant to meet the requirements of men who cannot afford the time to attend the whole of either of the two other courses, and the subjects are chosen from the standard courses of the College to meet their particular requirements. The type of student who is likely to attend these courses is the officer of a Colonial Agricultural Department who requires to take a "refresher" course, or a member of some other scientific institution who may wish to study in some particular branch of science for which Trinidad happens to possess particular facilities, or the owner or manager of an estate who wishes to gain further knowledge of some particular branch of his work.

In this connexion, there is now a distinct tendency to develop the idea of sending selected officers from the several Colonial Agricultural Departments to the College to undergo "refresher" courses,

and one cannot help thinking that this movement is in the right direction and will tend not only to increase the efficiency of the individual officer, but will also help the local Agricultural Department in its work.

Research Work.—Research is a most important function of the College, and with the increasing importance of tropical products in the economic position of the world as a whole, and of the British Empire in particular, it is bound to receive greater and more detailed attention. Broadly speaking, whilst much research has been done in agricultural matters in the temperate regions, comparatively little has been done, until recently, in the Tropics. The chief reason has, of course, been the paucity of trained researchers, but other factors have also contributed. For instance, in the realm of genetics, the plant breeder has naturally experimented with annual and quick maturing crops as he has thereby obtained his results much more quickly. Practically no attempt has yet been made to breed improved varieties of long period plantation crops such as coconuts or cocoa. This work is, in fact, not the function of an individual, but of an Institution such as The Imperial College of Tropical Agriculture, in which a series of investigators can pass on their results from one to another. No one can gainsay, however, that this work is of the utmost importance from the economic point of view, and that it will have to be undertaken sooner or later. A preliminary investigation of the cytology of both the coconut and cacao is now being undertaken with a view to further developments in the future.

Amongst the other activities of the Botanical Section, mention must be made of the breeding work on Bananas with the object of obtaining a marketable fruit that will stand transport, and will at the same time prove more resistant to Panama Disease than the Gros Michel. A note on this work has been published separately, but that its value has been recognised is shown by the fact that the Empire Marketing Board have recently given a substantial grant to the College to enable extended research to be undertaken.

Each of the scientific departments of the College is, however, engaged in research and it is impossible in this note to do more than refer briefly to a few of their activities in this direction. An account of the activities of the Committee that has been formed to investigate the Froghopper Blight on sugar-cane, a pest that is causing immense damage to the crop in Trinidad, has been published separately, and is to be read at the Agricultural Research Conference in London. It is sufficient to say, therefore, that the staff of the College are deeply involved in this investigation, and that the problem is being tackled from a very wide aspect, and has necessitated what is in effect a complete soil survey of the whole of the sugar cane area of the Colony. In addition the Chemical Section is continuing the work on the physical and chemical properties of cultural soils.

A commencement has been made into a study of the genetics of the sugar cane as distinct from the plant breeding methods usually employed at present. The latter methods have given results of great economic value but involve an immense amount of routine work, and are largely a matter of chance. The exact constitution of the parent canes are not at present known. It is felt that a study of genetics of the sugar cane plant, although it will probably prove a long and laborious business and may not give results of immediate economic value, will be of the greatest fundamental importance and should eventually lead to results that will prove of the greatest assistance to the cane plant breeder of the future. It is essentially a long time problem that can only be taken up by an Institution such as the College.

The Sugar Technologists are investigating the various impurities in the cane juice, and in particular the significance of the phosphate content. The bye-products of the cane factory are also receiving special attention, but the work of the College in this section has recently been outlined in a special Sugar Supplement of the College journal *Tropical Agriculture*.

In the Agricultural Section particular attention is being paid to the breeding of types of "heavy leaf" tobacco suitable for the local market. A detailed study is being made of different types of commercial bananas under field conditions, this work being a necessary corollary to that of the Botanical Section. Cover crops are being investigated in detail, and an attempt is being made to discover a suitable alternative or "resting" crop for sugar cane. Work on cotton is now left to a great extent to the officers of the Cotton Research Station of the Empire Cotton Growing Corporation, which is situated adjacent to the College, and cotton is grown only for demonstration and instructional purposes.

The Mycological Section is an important one as diseases of plants possess an even greater significance in the Tropics perhaps than they do in the temperate and sub-tropical regions. The control of such diseases as the withertip of limes, which is devastating large areas in this part of the world, is being considered from a different angle. A series of investigations into the cause and control of certain widely spread and destructive diseases of the coconut, such as the so-called "Wilt disease" has been commenced and affords a very wide field for research. So far as pests are concerned, a study of the various races of cotton stainer (*Dysdercus*) was commenced and a disease of bees has been investigated. It must be remembered, however, that the scientific officers of the College, in addition to their instructional and research programmes, are responsible for a certain amount of routine and identification work in connexion with the Colonies of the Lesser Antilles, which come within the scope of the Imperial Department of Agriculture.

The Economics of Tropical Agriculture offers a wide field for investigation as comparatively little has yet been done in this

direction. The methods of field costings employed in the temperate zone are not likely to prove applicable to the tropics, and it seems likely that a separate system, or systems, will have to be worked out. An enquiry into the various systems of Co-operative Credit Societies suitable for peasant farmers has been commenced.

Conclusion.

Trinidad is an admirable site for an Institution designed for Research and Training in advanced tropical agriculture. In the first place the climate is good for the tropics and the nights are usually cool. As a general rule the year is divided into two seasons, viz., a wet period extending from June to January, and a dry season for the rest of the year. The island is outside the hurricane zone.

A very large variety of crops are already grown on a commercial scale, and can be studied on the spot. Among these may be mentioned sugar-cane, maize, coconuts, rubber and coffee, rice, citrus, bananas and other orchard crops.

Most other tropical crops have already been proved to grow well also and can, therefore, be cultivated for purpose of study as required. In addition Trinidad is centrally situated so far as communications are concerned, and is served by several lines of mail steamers. It is only thirteen days from England, and is, therefore, far more easily accessible than most other parts of His Majesty's Colonies lying within the tropics. It has the further advantage that it lies in close proximity to the Spanish Main and to the islands of the Caribbean. These possess distinctive climates and often specialise in particular crops. To the student of sugar-cane a visit to British Guiana will, for instance, reveal the fact that the system of cultivation is as different from that of Trinidad as the latter is from the Barbados method. With regard to special crops, St. Vincent is famous for its arrowroot, Grenada grows its cacao by a special system without shade, and is also growing nutmegs on a commercial scale. Another spice—vanilla—is being produced in Dominica, and several of these islands are specialising in particular strains of Sea Island cotton.

The value of the College has been recognised by both the Colonial Office and the Empire Cotton Growing Corporation, since both send their scholarship holders for a final course of training in Trinidad before posting them abroad. Several Colonial Governments have also sent selected officers who are on the staff of their Agricultural Departments to the College for what may be called "refresher" courses.

As a centre for research in Tropical Agriculture it obviously presents many advantages, and scientists from other Universities who may wish to enter into some particular investigation are always welcomed and given every facility during their stay.

9. MAURITIUS : MEMORANDUM.

Advantages for the Extension of Sugar Research on an Imperial Basis in Mauritius.

In what follows the attempt is made to indicate the special attractions and advantages which the Colony offers as a centre for extension of research in its Imperial aspect with special reference to sugar.

The need for organisation for the improvement of supplies of British-grown sugar is evident and in this direction research is essential. In relation to cane sugar, a large area of land in the British Tropics is available for exploitation, particularly in our East African possessions, and there seems to be reason to hope that in due course such developments may take place.

There is no agricultural industry which demands the application of scientific method to so great an extent as does sugar production. On the agricultural side there is still a considerable field for work in breeding new kinds of cane, and there are many problems in relation to the physiology and nutrition of cane still awaiting solution. On the manufacturing side the extraction of sugar from the cane as well as from the beet is probably the most complex chemical-technical process applied to any vegetable product, requiring more elaborate processes and more expensive machinery for its efficient performance than almost any other agricultural industry. For its improvement, continuous research provision is essential.

Mauritius is situated in reasonably close proximity to East Africa, and there is frequent and regular communication; as an established centre of sugar production from which instruction can radiate, Mauritius is in this way favourably situated.

In so far as the breeding of new cane varieties is concerned, Mauritius offers great advantages: the work of raising seedling cane is easy owing to the remarkable fertility which cane seed show under the climatic conditions there prevailing. Also the occurrence of new varieties by discontinuous variation through bud sporting is of more frequent occurrence than in almost any other cane sugar producing country. Added to this the country has fortunately so far been kept free from the major cane diseases, viz., Mosaic, Sereh and the Fiji disease. On the manufacturing side the country possesses 44 sugar factories, which, though few, if any, are absolutely up to date, yet are quite sufficiently developed to permit of modern processes of manufacture being studied under favourable conditions, while co-operation from the usiniers is readily forthcoming.

Investigations on many lines have already been conducted or are in progress at present, further extensions are in contemplation, but it is doubtful whether the facilities which exist are capable of being developed to their fullest extent by local efforts alone.

It is, therefore, suggested that the Colony offers peculiar facilities

as a site for investigation in relation to cane sugar production. These facilities may be summarised as follows :—

1. The natural advantages offered by the Colony as a site for systematic research into sugar questions, viz. :—

- (a) Climatic and soil conditions admirably suited to the cultivation of the sugar cane and the production of new varieties.
- (b) A geographical situation particularly favourably situated in relation to the regions in which the production of Empire grown sugar may be expected ultimately to expand very greatly.
- (c) The absence of the more important cane diseases, particularly Mosaic, which thus greatly facilitates the production and distribution of canes to other centres without risk.
- (d) The possession of a climate which in the higher altitudes is much less enervating than most tropical climates.

2. The existence of regular and frequent mail steam connections with Europe and East Africa, and also at more irregular intervals with Ceylon, India and South Africa.

3. The existence of an important and long established sugar industry, operated on modern lines, by an intelligent and progressive personnel, and affording enough opportunities and facilities for collaboration in research scheme.

4. The existence of a well-established and equipped institution for agricultural teaching and research, the operations of which are already soundly organised, and which is already accomplishing a considerable amount of useful research work, and of which the scope could be greatly extended.

In view of the foregoing facts, it is considered that these facilities should be taken due account of in any scheme for the co-ordination and extension of agricultural research in the Empire.

10: TANGANYIKA : MEMORANDUM.

Development of Agricultural Research Institutions in Central Africa.

It is well recognised that an essence of their quality is that research institutions are not intended for doing the work of ordinary agricultural stations. On the other hand it is the limitations of the latter in regard to research work and the importance of avoiding repetition and overlapping of investigation that has helped the necessity for the research institution to be made evident.

Although their first purpose is that of fundamental research, the development of agricultural research institutions is largely guided by the needs of agricultural investigation which are made

evident through those of agricultural stations serving directly the agricultural breadwinner in whose interest the whole organization has been devised. The limitations of weak research institutions cannot be given compensation by the activities of agricultural departments; and it is a fact of equal importance that, as the provision for research in the former becomes stronger, the facilities possessed by the latter have to be increased in order that their mutual activities and stimulus may be made properly effective. So-called economy in respect of agricultural departments cannot be supported by the excuse that institutions for research are provided in the area which they partly serve.

Experience has made it an axiom that the existence of research and teaching in the same institution increases its efficiency and liveliness in both of these directions; so that the research station comes to be regarded primarily as an educational institution: we have an example in the Imperial College of Tropical Agriculture in the West Indies. The teaching side of such an institution cannot, however, be extended indefinitely: in fact the number of students in each should be strictly limited, lest both teaching and research suffer. This forms another reason why agricultural research institutes in Central Africa should as quickly as possible develop their teaching side for those who wish to specialize in tropical agriculture after coming down from the University and for those who desire to take up post-graduate research in the range of subjects comprised in it; should in fact add to the facilities for these already afforded by the Imperial College of Tropical Agriculture.

There appears to be another legitimate claim which will affect the development of agricultural research institutes in Central Africa. An increasing number of planters and farmers is, and is becoming, desirous for agricultural teaching for their sons who are to follow them in their work immediately after leaving school. It does not appear that special establishments for this purpose can at present be provided. Consideration of the matter seems to show that these facilities will be most effectively supplied by the development of the research institutions in such a way that the teaching staff already available in their researchers, assisted by those scholars and post-graduate and refresher students who are fitted for the work, shall give during an appropriate period of the year courses of instruction suited to planters and farmers, who will not necessarily be only those leaving school, but (following similar work at Rothamsted) may be as well those already working or managing plantations or farms who wish to improve their knowledge and keep themselves familiar with the latest developments of tropical agriculture.

Research institutes of the kind under discussion should also provide facilities for refresher courses for officers of agricultural departments, thus keeping them in close correspondence with the subjects of their work and avoiding expenditure necessitated by the taking of such courses in England; and these courses (as well as

facilities for post-graduate research) should be available for workers in other countries, through an elastic system of exchange. Incidentally, all these developments will supply the physical facilities for entertaining agricultural conferences, both general and particular.

The wider the appeal and the more open its intentions the greater the strength and effectiveness of an agricultural research institution. In tropical Africa agriculture is the great breadwinner; and if such institutions do not make that wide appeal it will be demanded of them.

11. NIGERIA : MEMORANDUM.

Agricultural Colleges and Central Research Institute.

By O. T. FAULKNER.

The suggestion has been made recently that there is a need for a chain of central agricultural research institutes, each serving a group of Crown Colonies and Protectorates. I suggest that what is wanted is not a chain of central agricultural research institutes, but a chain of agricultural colleges. The agricultural colleges are needed for the colonies literally as agricultural colleges, and would be, in addition, the most practical form of central agricultural research institute. This is on the assumption that the purpose of the central agricultural research institute is to carry out research into problems connected with agriculture, which are not problems of obvious immediate economic importance to any one colony. Research work on local economic problems is obviously better undertaken by the local departments than by a "central" institute.

2. On being transferred from Malaya to India, and again from India to Nigeria, nothing impressed me more than the different position occupied by the highest grade of native assistant, and consequently the nature of the work of the European research officers. In India, the European research worker's daily work consisted mainly in directing the work of his staff of three or four of the highest grade of Indian Assistant. He himself only carried out particularly difficult operations, worked on methods which were new to that particular laboratory before teaching them to his staff, checked the work of his staff, worked out results, &c. The highest grade of assistant was again capable of superintending the work of younger assistants engaged in routine work like the chemical analysis of soils. In most colonies the highest grade of native assistant is not equal to the lowest grade of Indian assistant. The main cause behind these differences is, of course, the agricultural colleges which were established in India as soon as the agricultural departments were formed.

3. Further there are considerable differences between the amount of effort that has been devoted to the different agricultural colleges in India, and a comparison of different provinces shows that those provinces in which the European officers of the Agricultural Departments have devoted most effort to the college, are in the strongest position in regard to all sides of their work.

4. Unquestionably the Indian Agricultural Department has been able to attain this much stronger position in regard to the training of assistants in colleges, largely because of the more advanced condition of India generally in regard to higher education. But in a matter of this sort it is always difficult to avoid the "argument in a circle"—in the colonies the question of the provision of colleges has hardly been considered because of the scarcity of boys with secondary education who could take advantage of a college. And I suspect there is tendency to neglect secondary education, because there are no technical colleges to take boys turned out from a secondary school. Again, there is little demand for college-trained assistants because the research workers and technical officers do not realize how much can be done by native assistants, who have had an efficient advanced technical training, because they have never had personal experience of such assistants.

5. Another important object of the provision of the agricultural colleges, is as an alternative to the young native trained in a European or American University who desires appointment to the European ranks of the service. Indians in the "European ranks" are, or have been, recruited in both ways—young men who have taken courses in England or America, and men selected from among those who had been trained in the Indian Agricultural Colleges and reached the highest Indian grade (the provincial service) by accelerated promotion through the grades of native assistants. I think that everyone who has had experience of the two classes of men will agree with me that, as a class—there are always exceptions to any such generalizations—the men promoted from the assistant grades do infinitely better, and have a much more valuable influence in the country. This holds good even when, as is frequently the case, the provincial service man takes leave for a year or two and takes a post-graduate course in Europe to strengthen his claims for promotion. This is really a question of experience, and the reasons for it are of secondary importance, but are sufficiently well known to everyone with experience of this subject.

6. In many cases it is clearly impracticable at present for an individual colony to maintain a properly staffed and equipped agricultural college, without unduly sacrificing the other functions of the department—that is if the word "agricultural college" is used, as I use it, as meaning a college equivalent to the English agricultural colleges. Considerations of finance alone render a

college hardly possible for many individual colonies. Another difficulty is the fact that in many colonies there is hardly any avenue of agricultural employment, except the local department, for any considerable number of men trained at an Agricultural college; and the number required each year by the local department is not large enough to absorb the whole product of a college.

7. On the other hand, the conditions in the Eastern colonies, in West Africa, in the West Indies, and, I imagine, also in the East African group of colonies, are each so different, that it is questionable whether it will be satisfactory to send natives to a college further afield than a central college serving one group of colonies.

8. I suggest that the Agricultural College serving a group of colonies is the most practical way of providing for the carrying out of the research work, which I presume would be carried out, by a central research institute for such a group. In the first place men teaching agriculture or agricultural science at a college standard must be allowed to do some research work, or otherwise their teaching will deteriorate. Indeed a suitable type of man could hardly be obtained and retained unless allowed to undertake research work. As soon as a man starts to teach agriculture, or any agricultural science, in the Tropics, the gaps in our knowledge of the subject impress themselves upon him, in directions in which he needs definite knowledge or data to make his courses of lectures intelligible and applicable to local conditions, but in which the local department cannot afford to investigate because they are not of direct economic importance. Thus the man who teaches in a college becomes the best man for carrying out the sort of research work which should be carried out at a central research institute. To put the same thing in another way, the most obvious value of fundamental research work is to provide the general knowledge of his subject, which enables the worker on economic problems to know how to set to work: this is practically the same as saying that its most obvious value is in connection with technical education. Most workers who have had experience of doing both kinds of work simultaneously will agree that teaching and research work both benefit through being done by the same man.

9. The chief difficulty in connection with agricultural colleges, at least for some groups of colonies at present, will be the absence of boys or men educated to such a standard as will enable them to enter an agricultural college. I suggest that it should be the function of each agricultural department to produce such men, if they are not already available. The ideal system would seem to be that each agricultural department should have a secondary agricultural school, providing education in elementary science and in agricultural subjects, in addition to English and Mathematics of a practical nature for a science or technical student. It should not

be difficult for each department to do this, as it will only mean the employment of one special schoolmaster to teach English, mathematics, and elementary science in the junior classes. It is not too much to ask of the technical staff of the department that they should undertake the education in agricultural science and agriculture of the senior classes at the secondary school, since they would only have to devote each an hour or two per week to teaching. Selected men from the departments' schools would go to the college, those less successful in the schools would provide a lower grade of assistant.

10. It is highly undesirable that an Agricultural College should be established anywhere unless and until it is possible to provide for education and training truly of college standard; for more harm than good is done by creating what is really a school and calling it a college; or creating a college which purports to provide education of a high standard, but which is so poorly staffed, either as to quality or quantity, that the training is pretentious but not efficient. Such a state of affairs is most unsatisfactory, for it results in the departments having an inefficient staff, and it also results in great disappointment to the ex-pupils, who believe that they have been educated up to taking more responsibility than they are actually capable of bearing.

